



The effect of Saudi Consumers' Awareness and Attitude Towards Saudi Food and Drugs Authority' Food Policies on Body Mass Index

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Abstract

This paper aimed to examine the effect of Saudi consumers' awareness and attitude towards Saudi Food and Drugs Authority's (SFDA) food policies on their average Body Mass Index (BMI), and whether consumers' socio-economic variables impacted their BMI. In this cross-sectional study, 584 Saudi adults completed an electronic questionnaire. The results of a two-sample t-test showed that there was a significant difference in the mean of BMI among consumers who followed SFDA news and regulations and those who did not. Also, the findings revealed that the BMI mean of consumers who cooperated with SFDA by reporting food safety violations was significantly different compared to consumers who did not cooperate with SFDA. The results of the binary logit model indicated that several socio-demographic characteristics (age, gender, income) impacted consumers' BMI. The findings of this study may assist nutrition educators and policy makers to plan programs to improve health-related behaviors.



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Introduction

The prevalence of overweight and obesity has become a significant public health issue, worldwide. In adult population (aged 18 years and over), 39% are overweight, and 13% are obese.¹ In 2013, overweight and obesity affected 30.7%, and 28.7%, respectively, of adult (15 years and

older) in Saudi Arabian.² Obesity is among the major causes of co-morbidities including diabetes, cardiovascular diseases, some types of cancers. In addition, obesity related illness may lead to morbidity and mortality.^{3,4,5} The total cost of obesity and overweight is considered a relative high burden on both health care systems and for society.⁶

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Taking into account Saudi Arabia's 2030 vision and WHO guidelines on eliminating non-communicable diseases, the Saudi Food & Drug Authority (SFDA) aims to reduce the levels of sugar, salt, and saturated and transformed fat in food products.^{7,8,9,10} It also raises the awareness and adoption of food products manufacturers and importers to reduce these contents and include the calories levels in restaurants and cafes' menus to determine the daily calorie consumption per capita. In 2019, the SFDA launched several food policies to increase consumer awareness and promote healthy eating habits. These policies include: 1) obligating restaurants and coffee shops to display calorie amounts in their products; 2) reducing salt content in food products, especially bread; 3) eliminating hydrogenated oils in food products; 4) preventing misleading nutritional information on food products; 5) preventing food advertisements without permission.

Some researchers have indicated that such policies may get implemented if they are supported and adopted by the general.^{11,12,13,14} In addition, consumers may support a policy if it is useful, relevant, and applicable to their life. Moreover, food and nutrition policies' support may vary based

on individuals' socio-demographic and economic characteristics.^{15,16,17} However, to our knowledge, no study to date has assessed public awareness and attitude towards SFDA food policies and regulations. Therefore, the primary purpose of this study is to assess public awareness and attitude towards these regulations in Saudi consumers. In addition, the study aimed to examine whether public awareness and attitude towards SFDA policies and regulations have a significant impact on their average Body Mass Index (BMI) and to examine the impact of socio-economic variables on consumers' BMI.

Material and Methods

Using a simple random sampling method, the data of this cross-sectional study were collected through self-completed online survey, distributed via social media networks and targeted Saudi consumers (18 years old and above). The survey questions collected demographic data and included questions on whether the public were aware and supportive of SFDA food policies and regulations. Table 1 presents survey questions related to SFDA food policies and regulations. The study protocol was approved by King Faisal University's Research Ethics Committee (KFU-REC/ 2020-05-13).

Table 1: Survey Questions

Item	Question
Q1	I always am aware of updated SFDA educational awareness messages
Q2	Generally, I'm satisfied that SFDA obligated food companies to provide calorie amounts in their products
Q3	Obligating food companies to provide calorie amounts in their products has helped increase my awareness about foods and beverages
Q4	Knowing calorie amounts in food products has helped decrease eating out
Q5	I know how to calculate my daily food calorie needs
Q6	I'm satisfied that SFDA obligated food companies to reduce salt amounts in bread
Q7	I know the daily amount of salt my body requires
Q8	I read the nutritional label on food products
Q9	I'm satisfied with SFDA's policy of eliminating hydrogenated oils in food products
Q10	I support the SFDA's policy of preventing writing misleading nutritional information on food products
Q11	I support the SFDA's policy of preventing food advertisements without permission
Q12	Preventing food advertisements without permission saved my right as a consumer
Q13	I follow SFDA's news and regulations through SFDA's media channels
Q14	I cooperate with SFDA by reporting SFDA's policy violations related to food safety

Our empirical analysis mainly depended on two sample t-test to examine differences in means of

different groups and a multivariate linear regression model to examine the impact of demographics

variables on respondents' BMI. The multivariate regression model was expressed as below:

$$BMI = \beta_0 + \beta_1 x_i + \gamma_1 D_i + \epsilon_i \quad \dots(1)$$

Where x_i is a vector of explanatory continuous variables, D_i is a vector of binary variables, and ϵ_i is the error term. Furthermore, β_0 is the intercept, β_1 , and γ_1 are coefficients to be estimated.

Since the BMI score cannot exceed 54 nor fall below 12, there is a lower and upper limits on the BMI score. For example, if we want to calculate an individual BMI from the person's height and weight, we will get a value that is not greater than 54 or less than 12. This is the case of censoring above and censoring below because we are certain that the value of respondents' BMI in our sample cannot exceed 54 nor go below 12. Thus, in order to examine the effect of socio-economics variables and social media variables on respondents' BMI, the optimal model to use was the tobit model. The censored (tobit) model was expressed as below:¹⁸

$$y_i^* = x_i' \beta + \epsilon_i \quad \dots(2)$$

$$y_i = \begin{cases} a & \text{if } y_i^* \leq a \\ y_i^* & \text{if } a < y_i^* < b \\ b & \text{if } y_i^* \geq b \end{cases} \quad \dots(3)$$

Where y is the BMI, x_i are explanatory variables, ϵ_i the error term, a is the lower limit of the BMI score, and b is the upper limit of the BMI score.

Results

After eliminating incomplete or unreliable data, the total number of participants were 584 adults (18 years old and above) from all Saudi Arabia's five regions (Central, Western, Eastern, Southern, and Northern). Table 2 presents a brief description of the nominal and ordinal variables. About 77% of the participants were female, and the average age was 31.5 years. As for the participants' BMI, the average was 25. 35.4% of respondents are employed, and almost 64% of them were married. 58.4% of respondents held a bachelor's degree, and their monthly income was almost distributed equally among different income categories.

Table 2: Survey Results

Variable	Count	Percentage	Variable	Count	Percentage
Q1			Gender		
Agree	247	42%	Male	136	23%
Disagree	337	58%	Female	448	77%
Q2			Occupation		
Agree	560	96%	Employed	207	35%
Disagree	24	4%	Student	184	32%
Q3			Unemployed	193	33%
Agree	545	93%	Marital Status		
Disagree	39	7%	Divorced	19	3%
Q4			Married	313	54%
Agree	382	65%	Single	247	42%
Disagree	202	35%	Widow	5	1%
Q5			Education Level		
Agree	326	56%	Less than high school	21	4%
Disagree	258	44%	High school or equivalent	154	26%
Q6			Bachelor degree	341	58%
Agree	535	92%	Post graduate degree	68	12%
Disagree	49	8%	Household Income		
Q7			Less than SAR 5,999	125	21%
Agree	273	47%	SAR 6,000-9,999	115	20%
Disagree	311	53%	SAR 10,000-13000	128	22%
Q8			SAR 14,000-18,999	86	15%
Agree	403	69%	Over SR 19,000	130	22%

Disagree	181	31%			
Q9			Q10		
Agree	553	95%	Agree	561	96%
Disagree	31	5%	Disagree	23	4%
Q11			Q12		
	565	97%		560	96%
	19	3%		24	4%
Q13			Q14		
	256	44%		394	67%
	328	56%		190	33%

*Please refer to table 1 for more details on the survey questions.

The results showed that even though 56% of the study participants followed SFDA's latest news and regulations via social media accounts, 42% of the participants were aware of the latest SFDA's educational awareness messages. However, 96% of the participants were satisfied that SFDA obligated restaurants and coffee shops to provide calorie amounts in their menu. Furthermore, 93% of the participants agreed that obligating restaurants and coffee shops to report calorie amounts increased their awareness about food and beverage consumption. In addition, 65% of the participants agreed that knowing calorie amounts helped them decrease eating food outside. Nevertheless, about 56% of the participants knew how to calculate their daily food calorie needs.

Regarding the SFDA policy of obligating food companies to reduce salt amount in bread, 92% of respondents were satisfied with that policy even though 53% of respondents did not know the daily amount of salt their body needed. Additionally, 69% of the participants reported that they read nutrition labels on food packages, and 95% of the participants agreed with SFDA's policy to eliminate hydrogenated oil from food products. Furthermore, 96% of the participants were supportive of SFDA's policy to prevent writing misleading nutritional information on food products, and 97% of the participants were supportive of SFDA's policy of preventing food advertisements without permission. Moreover, 96% of the participants agreed that preventing food advertisement without permission protect their rights as consumers. Even though 56% of the participants did not follow SFDA news and food policiesthrough SFDA's social media platforms, 67.5% of the participants cooperated with SFDA by reporting food safety violations.

The first objective of the paper was to examine if consumers' awareness and perspective towards SFDA policy and regulations had a significant impact on their BMI scores. Thus, the two sample t-test was used to examine the null hypotheses. The first step in the t-test was to conduct Levene's test for homogeneity of variance. The null hypothesis of Levene's test was that the variance was equal between the groups. The results of the Levene's test (available upon request) showed that we failed to reject the null hypothesis of equal variance. Therefore, we used two sample t-test assuming equal variance.

The results showed that there was a significant difference in the average BMI of consumers who agreed and who did not agree that knowing food calorie had helped them decrease eating outside homes ($p = 0.001$). The value of Cohen's D was 0.28, indicating a small effect size. Also, there was a significant difference in the means of BMI among consumers who were satisfied with SFDA's policy to reduce salt amounts in bread and who were unsatisfied with that policy ($p = 0.002$). The result of Cohen's D was 0.46, indicating a small effect size.

Furthermore, the t-test results showed that there was a significant difference in the average score of BMI for consumers who followed SFDA news and who did not follow SFDA news ($p = 0.011$). This indicated that consumers who were updated with SFDA news and regulations through SFDA official media channels had a BMI that was significantly different than other consumers who did not follow up with the SFDA news and regulations. Lastly, consumers who cooperated with the SFDA by reporting food safety violations had an average of BMI score that was significantly different than consumers who

did not report food safety violations to the SFDA ($p = 0.005$). Surprisingly, the results showed that there was no significant difference in the average BMI among consumers who read and who did not read the nutritional label on food products ($p = 0.427$). Moreover, there was no significant difference in the average BMI score among consumers who knew and who did not know how to calculate their daily food calorie needs ($p = 0.100$).

The second objective of the study was to examine the impact of demographical variables on consumers' BMI. Thus, the ordinary least squares (OLS) method was used to estimate the impact of age, gender, occupation, income level on consumers' BMI. The results are shown in table 4. The R^2 in the first model was 0.16, showing that the model only explained 16% of the variance in the BMI. Thus, we run a second model with an interaction term between age and weight. The reason for adding the interaction term was that the level of consumer weight was related to their age. Moreover, we observed that the interaction term was significant at the one percent level, and the model's R^2 was then 0.75, showing that the model explained 75% of the variance in consumers' BMI.

Before interpreting regression results, we run series of diagnostic tests to ensure that our model was best linear unbiased estimator (BLUE).

We run Ramsey RESET test, and the results (available upon request) showed that our model was correctly specified. In order to test the OLS assumptions that the errors had constant variance (homoscedasticity), we used Breusch–Pagan test. The null hypothesis of Breusch–Pagan test was that the error variance was constant (homoscedasticity). The results of the test were rejected at the one percent level homoscedasticity assumption. Thus, we had heteroscedasticity problem. Thus, we run model 3 using heteroskedasticity robust standard error. We also tested for multicollinearity, using variance inflation factor (VIF). The values of VIF for all independent variables were less than 5.5, showing no multicollinearity among our independent variables.

Based on model 3 (Table 3) since it had the correct standard error, the results showed that for an additional year in consumers' age, their BMI was expected to decrease on average by 0.652, holding other variables constant. Also, men's BMI were less than female's BMI by 3.65 units. Furthermore, consumers who were students had an average of BMI that was less than employed consumers by 1.36 units. Also, consumers who had a monthly income in the range of SAR 14,000-SAR 18,999 SAR, had a BMI value that was less by 0.830 units compared to consumers whose monthly income was less than SAR 6,000.

Table 3: Impact of Socio-Economic Variables on BMI

Variable	Model 1 No Interaction Term	Model 2 Interaction Term	Model 3 Interaction term and heteroskedasticity robust standard error
Intercept	21.982*** (1.144)	27.325*** (0.642)	27.325*** (0.777)
Age	0.179*** (0.028)	-0.652*** (0.027)	-0.652*** (0.039)
Male	-0.387 (0.626)	-3.648*** (0.353)	-3.648*** (0.388)
Student	-1.785** (0.714)	-1.364*** (0.39)	-1.364*** (0.430)
Unemployed	-0.49 (0.612)	0.039 (0.335)	0.039 (0.364)
Income Over 19,000 SAR	-0.709 (0.747)	-0.125 (0.408)	-0.125 (0.362)

Income 14,000-18,999	-2.328*** (0.815)	-0.830* (0.447)	-0.830** (0.381)
Income 10,000-13,999	-1.399* (0.728)	-0.312 (0.399)	-0.312 (0.362)
Income 6000-9,999	0.19 (0.742)	0.276 (0.406)	0.276 (0.462)
Age*Weight	-	0.009*** (0.0002)	0.009*** (0.0003)
R ²	0.16	0.75	0.75

Note: ***, **, * indicate significance level at the one, five, and ten percent level, respectively.

Discussion

Numerous countries, including Saudi Arabia, are considering nutrition and food policies to improve dietary behaviors related health outcomes.^{12,13,19,20} A potentially powerful role for food policies is to support an environment that encourages healthy preference and the learning of healthy behaviors. This study sought to examine the effect of Saudi consumers' awareness, attitude, and socio-economic variables on consumers' BMI.

In this study, many Saudi consumers followed SFDA's latest news and regulations and were supportive of SFDA's food policies. Particularly, high support was for food policies of requiring restaurants and coffee shops to report calorie amounts in foods and beverages, reducing salt amount in bread, eliminating hydrogenated oil from food products, and preventing written misleading nutrition information on food products, and preventing food advertisements without permission. These findings are consistent with similar studies in Australia, Canada, Mexico, the U.K., and the U.S.A., where people tend to support intrusive food polices, such as calorie menu labeling, food package warnings, and maximum salt levels for packaged products.^{19,21}

In the current study, Saudi consumers agreed that such food policies had increased their awareness of what they consumed, and they even cooperated with SFDA by reporting food safety violations. However, about 50% of the Saudi consumers participated in this study lacked in knowledge of their daily calorie and salt needs. Similar findings were reported in a study on Saudi adults that found that at least 50% of the participants were able to identify the correct energetic intake for moderately active men and women.²² Yet, only 36 % of the participants reported the correct energy requirements for inactive adults.

Implementation of policy actions, such as population education and point-of-purchase labelling are increasingly and widely used.²³ Increasing nutrition education messages on the calculation of calorie and nutrient needs and healthy food choices are needed for Saudi adults in order that they are able to interpret the values on food packages for their individual needs.

The study results showed that there was a significant difference in the mean of BMI between the participants who agreed and the participants who disagreed that knowing food products calories amount had helped decrease eating out. Likewise, there was a significant difference in the mean of BMI between the participants who were satisfied and those who were not satisfied that SFDA required bread producers to decrease salt amount. Furthermore, there was a significant difference in the mean of BMI between the participants who followed SFDA news and those who did not follow SFDA news.

In addition, the participants who cooperated with SFDA by reporting food safety violations were found to have significant difference in their BMI means compared to those who did not cooperate with SFDA. These findings, supported by statistical significance, meant that participants' awareness was reflected in their average BMI. The outcomes of significant impact of public support and awareness for these SFDA's policies on BMI were also reported by Bhawra *et al.* who found an association between the BMI and the public support, particularly the higher the BMI, the more support for menu labelling among Canadian youth and young adults.¹⁹ The study suggested that this might be reflective of an increased interest in nutritional information, such as calories.

The study results indicated that several socio-demographic variables were significantly associated with food policy awareness and support. While previous studies similarly found socio-demographic characteristics to be associated with policy support, the direction of these relationships varied across studies. For example, in a study by Julia *et al.* found that older French adults were more likely to support a sugary drink tax,²⁴ while a study by Curry *et al.* found that young American adults were more supportive of such a tax.²⁵ In addition, a greater health consciousness among women supporting food policies had been reported previously.^{21,26} In the current study, awareness and support for food policies generally were among middle class income male young adults who were employed. Saudi young adult participants in this study might be more health conscious. Additional information on Saudi adults' attitudes and beliefs was not collected in the present study, and this may be an area for further exploration. Moreover, further studies are needed to and further understand the influence of demographic characteristics on policy support.

Conclusion

The key strength of this study is its novelty, being the first attempt to assess Saudi public support and awareness of SFDA's food policies to change dietary and health related behaviors. Future qualitative studies are needed to better understand why these policies receive public support, and to examine the differential influence of certain sociodemographic characteristics, such as household income and education levels, on policy support. Nevertheless, the findings should be interpreted in of the study's limitations. The sample cannot be considered to be nationally representative since non-probability-based sampling was used to recruit participants. Due to collecting the study data electronically, the study sample differed from the general population, with a larger proportion of highly educated participants and those who had access and knew how to complete electronic questionnaires. In addition, BMI was calculated based on self-reported height and weight. Even though the cross-sectional study design is appropriate for determining food policy support, repeated surveys are required to assess how food policy support changes over time.

Lastly, the participants' actual knowledge of calorie and salt needs and their actual recall of any SFDA's educational awareness messages seen were not verified. Future studies could include a qualitative component that allows participants to give examples regarding these topics.

Overall, Saudi consumers reported high levels of support for SFDA food policies. Public perceptions and support generally impacted public BMI, especially for older age participants, males, and students. The findings of this study may assist nutrition educators to plan programs to improve health related behaviors and may assist stake holders and policy makers as public perception and social desirability are important to the policy-making and implementation process.

Ethics Approval

The study protocol was approved by King Faisal University's Ethics of Scientific Research.

Authors' Contributions

SHT conducted the study and collected and analyzed the study data. MA devolved the data analyzing models and analyzed the study data. The paper manuscript was prepared by SHT, with major contributions from MA. Both authors read and approved the final manuscript.

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Conflict of Interest

The authors confirm that this article content has no conflict of interest.

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